Make An Isostatic Model

Grades	2-6
Duration	60min
Setting	Classroom

TEKS

Science – Ch112

K.2 K.4 K.7 K.10 1.2 1.4 1.7 1.10 2.2 2.4 2.7 2.10 3.2 3.4 3.7
3.11 4.2 4.4 4.7 4.11 5.2 5.4 5.8 5.12

Focus Demonstrate movement and weight within the Earth.

➲ *Read side 2 for* Background.

Objective The student's task is to construct a model to mimic the weight and effects of ice on the Earth's upper layers.

Procedure

1. Working in pairs, have students fill their containers with enough water to float the wooden block.
2. The students can now place their wooden block into the water. *Explain that the wood represents a section of the crust and the water is the asthenosphere.*
3. Once the block has balanced itself in the water, have the students carefully mark the block's waterline with a crayon. *Mountains are "balanced" in the same way, with a "root" extending down into the asthenosphere.*
4. Now its time for an Ice Age! Guide the students through carefully placing ice cubes on top of the block. *The extra weight on the crust makes it sink lower into the asthenosphere.*
5. Continue lecturing and invite questions as the ice melts.
6. Have students record the changes in there journal, along with their ideas about the depth, temperature and composition of the Earth's layers.
   - *Whast happens as the ice melts?*
   - *What could this imply about the effect of glaciers and ice caps on the Earth's crust?*

Materials

- 1 water container
- 1 wooden block *(flat, rectangular)*
- water
- ice cubes

Did You Know?

At the foot of the world's deepest mineshaft, in South Africa, temperatures can reach 122°F (50°C). The temperature at the center of the Earth is probably about 5400°F (3000°C).

➲ *Read side 2 for* Background.

Make An Isostatic Model

Background

As your read this sentence, Africa is being torn apart from Asia, a new mountain range is being shoved up in the Mediterranean, the Red Sea is well on its way to becoming an ocean, and the Pacific Ocean is shrinking. But don't worry. All these events are happening so slowly that during our lifetime we won't even notice the changes.

A hundred years ago many geologists would have scoffed at the idea of moving continents and shrinking oceans. But today most accept the theory that continents, as well as the entire crust of the Earth, are "on the move." Geologists today believe that the Earth has a very specific structure, and that this structure is directly related to the forces inside the Earth, which help to power the changes we see on its surface.

The Earth Inside and Out

Since the early 1900s, geologists have known that the Earth is divided into three main layers: a thing outer **crust**, a thicker **mantle**, and a **core**. But exactly how these layers interact and what they are made of is still open to debate.

The crust is the only layer that geologists can really study first-hand. So geologists have had to study other data, such as the path earthquake shock waves take as they travel through the Earth, to find out more about the mantle and core.

A Thin Skin: The outermost layer of the Earth—the layer we walk on –is a thin, rocky skin that covers the planet. In relation to the Earth, this crust is about as thin as a postage stamp stuck on a billiard ball. At its thickest, which is under mountain ranges, the crust is only about 22 miles (35km) thick—about 1/200th of the Earth's diameter.

By comparing rock samples dredged from the ocean floor with those on the continents, scientists found there were two distinct types of crust: continental crust and oceanic crust. Continental crust makes up the continents and contains light-colored rocks (such as granite) composed mainly of the elements aluminum, silicon, and oxygen. This layer of the crust is much thicker than the oceanic crust, which forms the ocean floor. Although the oceanic crust is thinner, it is made of denser rocks (such as basalt) containing the elements iron, magnesium, silicon and oxygen. Because of the difference in densities, the lighter continental crust "floats" higher on the underlying mantle than does the oceanic crust.

The Movin' Mantle: Underneath the crust is the much denser mantle. Although no one has ever drilled into the mantle, geologists think it is made up of many of the same elements that form the crust. (The mantle is hotter and denser then the crust because the temperature and pressure inside the Earth increases as the depth increases.)

Although most of the mantle is made up of solid rock, geologists think it is composed of several zones. The uppermost zone, the area lying directly underneath the crust, is cooler and thus more rigid than the lower parts of the mantel. This thin uppermost layer of the mantle, combined with the thin, rocky crust, forms a rigid layer of rock called the **lithosphere**.

Fifty-miles beneath the crust and extending to 100 miles beneath the crust is a zone of molten rock. This zone is the deepest part of the mantle, called the **asthenosphere**. Geologists think that it is a hot, weak zone that is also solid, but can "flow" at a very, very slow rate. Geologists believe that the lithosphere "floats" on this more mobile zone in the mantle, and slides around on it very slowly. The lithosphere is constantly moving, floating on of the more liquid asthenosphere. The lithosphere slowly rises and falls as the weight of the crust above it changes at different points on the Earth's the surface.

Many geologists are convinced that strong **convection** currents exist within the mantle. (Convection is the process by which hot material rises to the surface, spreads and cools, and then sinks again, like soup being heated in a sauce pan.) These convection currents, which geologists think are fueled by heat given off by the core and some radioactive decay in the mantle, constantly transfer heat from the deep mantle to the crust at a very slow rate.

Heavy Metal: Deep within the Earth is the core—a mass of hot, heavy metals (mostly iron and nickel) that sank, due to gravity, after the Earth was formed. The core is almost twice as dense as the mantle and appears to be the main source of heat that triggers the convection currents in the mantle. Geologists know that the core is made up of two very different layers. The **outer core** is molten and is responsible for the Earth's magnetic field. And the **inner core** is solid.

Did You Know?

98% of all fresh water on Water is stored in glaciers and in polar ice caps. If these glaciers and ice caps melted, the seas would rise about 260 feet.

Bibliography & Sources

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